REMARKS

This application has been reviewed in light of the Office Action mailed on February 22, 2006. Claims 1 – 47 are pending in this application. Claims 2-9 and 25-32 have been amended to define still more clearly what Applicants regard as the invention. Favorable reconsideration is requested.

CLAIM REJECTIONS 35 U.S.C. §112

Claims 2-23 and 25-47 stand rejected under 35 U.S.C. §112, second paragraph as being allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The Examiner has asserted that the claims are confusing. The Examiner has noted that the preambles in the method claims state that a liquefied gas feed stream is fed to a fractionation column, and that the apparatus claim preambles state that a supply means supplies liquefied natural gas to a fractionation column. Claims 2-9 and 25-32 have been amended in response to this rejection.

CLAIM REJECTIONS 35 U.S.C. §103

The Examiner notes that the application currently names joint inventors. In considering the patentability of the claims under 35 U.S.C §103 (a) the Examiner presumed that the subject matter of the various claims was commonly owned at the name the inventions were made. The Applicants confirm that the Examiner's presumption is correct.

Claims 1 and 24 stand rejected under 35 U.S.C §103(a) as being allegedly unpatentable over either Prim or Marshall in view of Rambo et al. The Examiner asserts that Prim and Marshall each disclose Applicants' basic inventive concept, a liquefied natural gas processing system or method which heats the feed, separates the feed into a gas and liquid in a fractionating column and uses the overhead from the column to heat the incoming feed which

partially condenses the overhead stream with the liquid being fed to the upper portion of the fractioning column as a reflux stream substantially as claimed with the exception of splitting the heated feed to produce a vapor which is fed to the lower portion of the column and a liquid which is fed to the upper portion of the column. The Examiner states that Rambo et al. show feeding an LNG fractionation column with a lower vapor stream 31 which is heated in heat exchanger 12 and upper liquid stream 24(a) to be old in the cryogenic separation art. The Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of the Applicants' invention to modify the LNG fractionation system of either Prim or Marshall by splitting the heated LNG stream and feeding the vapor portion to a lower position on a column and the liquid to an upper portion to promote mixing of the stream in the column to promote separation.

The Claimed Invention And The Cited Art

The instant application describes and claims processes and apparatuses for the recovery of ethane, ethylene, propane, propylene and heavier hydrocarbons from a liquefied natural gas (LNG) stream. Independent process claim 1, claim 22 dependent thereon, independent apparatus claim 24, and claim 45 dependent thereon all feature an arrangement, illustrated in FIG. 10, whereby, *inter alia*, liquefied natural gas is heated and thereafter divided into first and second streams. The first stream is supplied to a fractionation column at an upper mid-column position. The second stream is heated sufficiently to vaporize at least a portion of it and thereafter supplied to the fractionation column at a lower mid-column feed position.

The specification describes nine prior art flow schemes that are illustrated in FIGS. 1-9. FIG. 4, which is reproduced below:

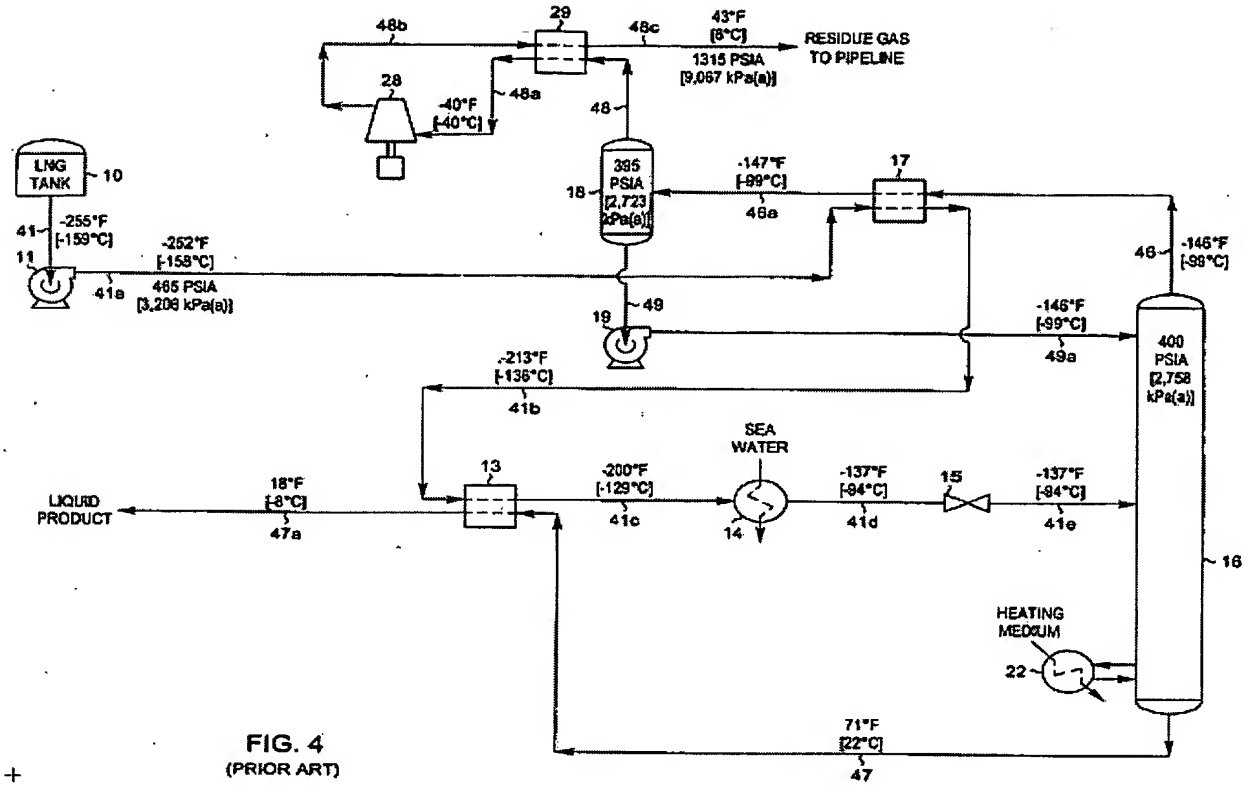

FIG. 4
(PRIOR ART)

depicts the LNG process of Marshall U.S. Patent No. 2,952,984. A detailed explanation of Fig. 4 is provided in paragraphs 0026 through 0031 and pages 12-15 of the specification. Note that two feeds are provided to the demethanizer 16: top column reflux feed 49a from reflux separator 18 and mid-column feed stream 41e.

FIGS. 10-20 illustrate embodiments of the instant claimed invention that are described in detail on pages 28 to 55 of the application. FIG. 10 is reproduced below:

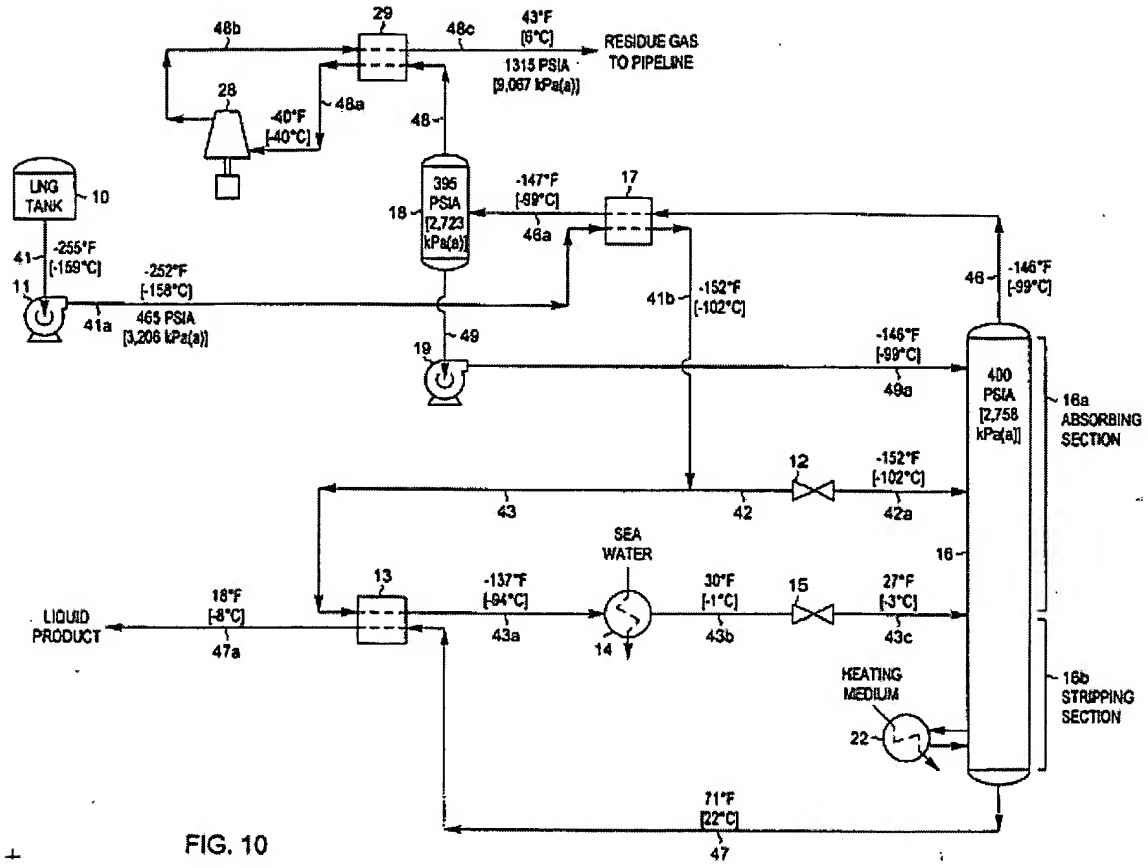

FIG. 10

It is contrasted with Marshall prior art FIG. 4 in specification paragraph 0059 as follows:

> compared to the FIG. 4 prior art process, splitting the LNG feed into two portions before feeding fractionation tower **16** allows more efficient use of low level utility heat, thereby reducing the amount of high level utility heat consumed by reboiler **22**. The relatively colder portion of the LNG feed (stream **42a** in FIG. 10) serves as a second reflux stream for fractionation tower **16**, providing partial rectification of the vapors in the heated portion (stream **43c** in FIG. 10) so that heating and vaporizing this portion of the LNG feed does not unduly increase the load on reflux condenser **17**.

The Applicants note in paragraph 0058 in the specification that "the high level utility heat required for the present invention is substantially lower", i.e. about 69% lower than that for the Fig. 4 Marshall process.

The Prim application discloses and claims a system and method for recovering C_2+ hydrocarbons from an LNG stream. The application includes four figures and 27 claims. Figure 1 is reproduced below:

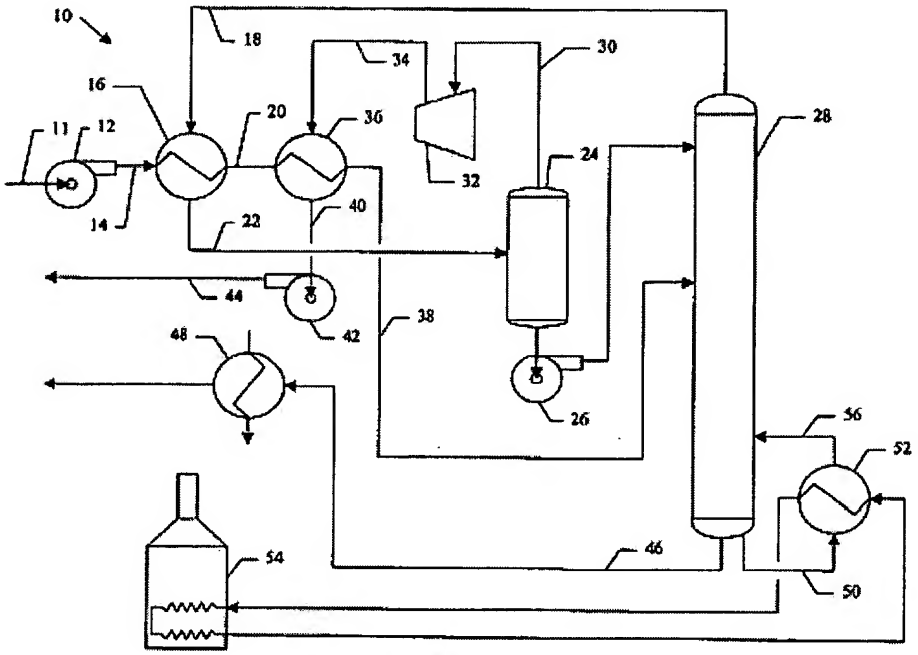

Figure 1

Prim discloses a process "that is capable of recovering a methane rich stream as a liquid". (Paragraph 0019). Pressurized feed stream 14 is warmed in heat exchanger 16 by overhead vapor stream 18 from tower 28. The condensed overhead vapor (now stream 22) feeds overhead drum 24. Reflux pump 26 pumps the liquid portion of the condensed stream 22 to a top column position on tower 28.

The vapor portion of condensed stream 22 forms overhead vapor product stream 30. That stream is then compressed (32) and thereafter directed (34) in heat exchange relation (36) with the first heated LNG feed stream 20. The compressed stream 34 is condensed in heat exchanged

36 to form overhead product condensate stream 40. That stream is then pumped 42 so that the methane rich liquid stream may enter a pipeline or other distribution system for further transport.

The second heated LNG feed stream 38 leaves exchanger 36 and feeds tower 28 at a mid-column location. Prim states in paragraph 0034 that:

> The optimum feed location is determined based upon the composition of second heated LNG feed stream 38 and upon the compositions of the desired overhead and bottoms product streams. The scheme does not rule out the possibility of feeding the column at multiple locations. The calculations are well known to a person having ordinary skill in the art and will not be repeated here.

In the Figure 2 embodiment, exchanger 62 preheats second heated LNG feed stream 38 with a portion of the heating fluid circulating through furnace 54 and reboiler 52. Figure 3 includes that same feature and also the preheating of second heated LNG feed stream 38 in feed bottoms heat exchanger 72 in advance of heat exchanger 62. In Figure 4, the same heat exchanger 72 is employed but not heat exchanger 62.

There is no suggestion of Applicants' claimed invention when the teaching of the Prim application is combined with the other cited prior art. Accordingly, the claimed invention is not obvious in view of the prior art. To establish a *prima facie* case of obviousness, three criteria must be met. First, there must be some suggestion or motivation in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Third, the combined references must teach or suggest all the claimed limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and must not be based on the applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ 2d 1438 (Fed. Cir. 1991). In this matter, there is no suggestion or motivation

in any of the references to combine selective portions of the Prim application and the Marshall patent with selective steps in the Rambo et al. process to arrive at the instant claimed invention.

The application claims 1, 22, 24 and 45 all require dividing the heated liquefied natural gas stream into first and second streams, supplying the first stream at an upper mid-column feed position to the fractionation column, heating the second stream sufficiently to vaporize at least a portion of it and then supplying it to the fractionation column at a lower mid-column feed position. In the claimed process and apparatus a major portion of the methane is recovered in the more volatile fraction. None of these claim elements is recited in or suggested by the Prim application. Prim's general broad statement in paragraph 0034 that the disclosed "scheme does not rule out the possibility of feeding the column at multiple locations" does not teach the division into two streams and the heating of the second stream sufficiently to vaporize it that is required by claims 1, 22, 24 and 45 of the application.

Rambo et al. is also distinguishable. Figures 7, 8 and 9 in the instant application provide illustrations of the process described in Rambo et al. U.S. Patent No. 5,114,451. FIG. 7 is reproduced below:

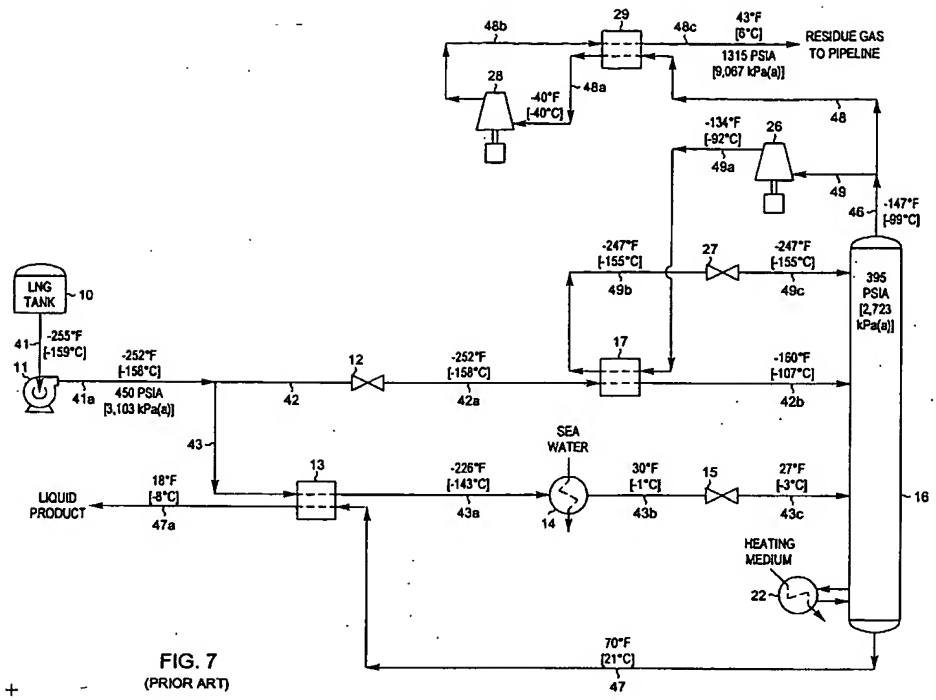

FIG. 7
(PRIOR ART)

The Applicants note the differences between Rambo et al. and the instant invention in paragraph 0059 of the present application as follows:

> compared to the FIG. 7 prior art process, using the entire LNG feed (stream **41a** in FIG. 10) in reflux condenser **17** rather than just a portion (stream **42a** in FIG. 7) allows generating more reflux for fractionation tower **16**, as can be seen by comparing stream **49** in Table X with stream **49** in Table VII. The higher reflux flow allows more of the LNG feed to be heated using low level utility heat in heat exchanger **14** (compare stream **43** in Table X with stream **43** in Table VII), reducing the duty required in reboiler **22** and minimizing the amount of high level utility heat needed to meet the specification for the bottom liquid product from the demethanizer.

Each of Prim, Marshall and Rambo et al. is distinguishable over Applicants' claimed invention for the reasons noted above. There is nothing in any of those cited references to suggest that certain differences should be ignored while selective aspects of one prior art teaching should be combined with or substituted for particular elements of one or two other citations to arrive at Applicants' claimed invention.

Conclusion

In view of the foregoing, the Applicants submit that the present invention is patentable over the cited references. Accordingly, favorable reconsideration of the application is earnestly solicited.

Respectfully submitted,

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